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Computer Systems Design Strategy and Priority Applications for Romanian Cities

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Computer Systems Design Strategy and Priority Applications for Romanian Cities

Summary

Romanian cities are engaging in an effort to develop general computer applications for local government and planning. They see information systems as a means towards achieving greater control over their own resources and activities and a step in the direction of achieving greater autonomy and less dependence on the central government in a key phase of the reform in Romania.

This report is intended to assist the cities in developing computer and information systems applications for local government and planning by providing specific suggestions regarding: (1) the types of information and applications in which computerization appears appropriate and cost-effective; (2) priority applications and a logical systems development process; (3) the principal data that should be computerized; (4) approaches and procedures for developing and obtaining appropriate hardware and software to create the identified applications; and (5) a scope of work for an initial priority systems development projects.

The suggestions and recommendations included in this report can be used by cities to develop a strategy for building and implementing information systems to support urban planning, budgeting and finance, and to insure more effective management of public administration functions and improved productivity.

ICMA Recommendations for Computer Systems Development

ICMA's main recommendations to Romanian cities in the area of information systems development for public administration uses are:

1. Develop a systems design strategy based on a philosophy of incremental development, and on lessons learned from the experience of local governments in the United States and Europe.
2. Evaluate realistically both needs and resources and follow ICMA's guidelines for successful development of computer applications for the local government (ICMA, 1988b).
3. Develop information systems with a modular and flexible structure, to allow more complex applications to be integrated in the initial system.
4. For the short term, rely on locally available software for planning and local government applications.

5. Perform a cost-benefit analysis which should take into account the total system costs, i.e. initial costs and operating costs.
6. Establish a local policy for hardware and software procurement and designate an in-house expert or experts to develop City Hall guidelines and specifications for hardware and software evaluation and procurement.
7. Develop a scope of work, level of effort, and schedule for an initial priority system which should address staffing and cost issues.
8. Designate a person responsible for the design and implementation of the system with the assistance of ICMA consultants.

The Use of Microcomputers in Local Government

Microcomputers can be used by local governments effectively and efficiently, provide valuable information for management purposes, and do the work of many people. Many local governments in developed nations depend on the use of computers and would find the cost of replacing computer-performed functions with personnel to be prohibitive. On the other hand, many local governments around the world failed in their approach to computerization, by including systems that were too costly, failed to perform up to reasonable expectations, had hardware inadequacies, and experienced software failures.

The Purpose of Automated Data Processing

The purpose of automated data processing is to provide complete, accurate, and reliable information for management purposes. Some of the reasons for buying microcomputers by the City Hall are: 1) improving accuracy; 2) saving time; 3) reducing or holding down the number of personnel; 4) improving productivity; 5) cutting costs; 6) doing more work; 7) doing work that could not be done before; 8) making work easier; 9) accomplishing tasks efficiently; and 10) improving the appearance of documents.

ICMA reports on computer applications in local administration make a distinction between two fundamental types of information management in local governments: housekeeping activities and decision-making activities. As a rule, housekeeping activities include: budget accounting, accounts payable, accounts receivable, payroll, personnel management, utility billing and accounting, tax billing and collection, departmental record keeping, word processing. Decision-making activities usually include "what-if" analysis, database management, decision support and geographic information systems (GIS). With the exception of word processing and departmental record keeping and personnel management, housekeeping activities are mainly concerned with financial

management and preparing and controlling the flow of funds to, within, and from a governmental organization.

Decision-making activities are significantly different from housekeeping activities. For example, the purpose of budgetary accounting, a routine housekeeping activity, is to produce information about actual revenues and expenditures in relation to their budgeted occurrence and in relation to the previous year's actual occurrence. Budget preparation, on the other hand, is a decision-making activity. Persons involved in the budgetary process will use data from the budgetary accounting system but their principal objective is to project future budgetary conditions. To do so, they will ask hypothetical or "what-if" questions about future revenues and expenditures. Budget preparation attempts to provide information so that policy makers can decide what to do in planning for the next budget cycle.

For computerized budgeting and accounting to be useful in making decisions in Romanian local government, the applications have to go beyond routine housekeeping activities, into providing summarized information, reports, economic indices, trends and patterns of income and spending to support economic decisions by the city council and the mayor.

A Strategy of Incremental Development

Any approach to building a strong and lasting capability in computer applications for the local government should start with a systems design strategy, which must assess realistically the local present and future resources, identify cost-effective computer applications, rank the applications in terms of priority, identify the data that should be computerized. An approach should be developed for obtaining appropriate software to create the application identified, and a scope of work for an initial priority systems development project should be outlined.

The general approach should be based on a small steps strategy, with a modular and flexible structure, which would allow more complex applications to be added and possibly integrated in the system. Excessive and unnecessary centralization of functions might overburden the system and might not be justified. Certain longer-term sophisticated applications such as Geographic Information Systems (GIS), Decision Support Systems (DSS), Executive Information Systems (EIS), and Operations Research (OR) models, can be quasi-independent. Such applications should integrate carefully selected information from less complex applications and routine attribute and geographic databases.

Acquiring Microcomputer Software

For most local governments, application programming is the single most important part of the microcomputer system. Each application program is made up of modules or sub-program elements. The more complicated the task, the more complex the program required, since a program models all procedures that must be performed manually to complete a task. City Halls have at least six options when acquiring microcomputer software (Norris, 1986): 1) off-the-shelf

software; 2) public-domain software; 3) packaged software designed for local government functions; 4) software developed by another organization which may have to be modified to meet local requirements; 5) custom software written by an outside organization; and 6) software created by in-house staff.

Off-the-shelf software is relatively easy to use, inexpensive, and available. The packages most used by local governments are word processors, spreadsheets, and databases. Public-domain software is programming that is available with no copyright protection which is often free or available for a nominal fee from microcomputer users' groups, electronic bulletin boards, and distributors of public-domain software. It is unlikely that such a resource will be available to Romanian cities in the short term.

Packaged software is programming written by software firms or value-added dealers. This option is always open to the Romanian cities, but it can entail high cost, hard currency, translation difficulties, and a steep learning and training curve. Software developed by another organization can be an effective solution to getting good programming at lower cost. However, there are negative aspects reported in such situations, which include a possible lack of documentation, lack of training, and lack of support. Many times programs must be modified by the purchaser, either using in-house staff or by hiring outside programmers.

Custom-written software, whether written by outside programmers or in-house staff, can be a short-term, ad-hoc solution to local government computer applications. However, it can be excessively expensive. It involves the work of people, instead of technology, and people's time is expensive; also, relatively few programmers know much about governmental requirements. Overall, this is a viable solution for Romanian cities, although the choice of locally developed software is quite limited.

Software Applications for Local Governments

Software packages and solutions currently available to local governments in highly developed countries are extremely diverse and sophisticated. For example, *ICMA Software Reference Guide 1992* lists a large number of packages available which cover local government functional areas such as:

- Administration (general management, project management, and request for service)
- Building Permits, Code Inspection
- Clerk's Office
- Courts
- Economic Development
- Finance (capital financing and planning, investment management, accounting, financial analysis and forecasting, fixed assets, insurance and risk management, payroll, tax assessment)
- Geographic Information Systems (GIS) and Mapping

- Health and Human Services
- Housing and Community Development
- Parks and Recreation
- Personnel
- Planning

- Public safety (including animal control, computer-aided dispatch, emergency management, emergency medical services, fire services, jail management, law enforcement)
- Public Works (including energy management, engineering, environmental management, procurement and inventory management, infrastructure-facilities-equipment management and maintenance)
- Transportation (including management, maintenance, planning and engineering)
- Utilities (including billing, management and maintenance)

Steps to Take in Developing a Computer System

The overall recommendation is to review the experience of cities of similar size which have gone through the process of building a capability in the use of computers for various city departments and functions. It is imperative to avoid costly mistakes, traps and pitfalls which many American, French, English, and German cities experienced with computers, while following the positive developments of the ones which were able to carefully assess, plan, implement, and maintain successful systems. ICMA's Reports and expertise are an excellent resource for learning about these experiences (see *References*). The steps to take in developing a computer system are:

Develop a Systems Design Strategy

A City Hall should start with a systems design strategy, which must assess realistically the local present and future technical and financial resources, identify cost-effective computer applications, rank the applications in terms of priority, identify the data that should be computerized. A scope of work for an initial priority systems development project is outlined in a later section of this report.

The general approach should be to develop information systems with a modular and flexible structure, which would allow more complex applications to be added and possibly integrated in the system. Sophisticated applications such as Geographic Information Systems (GIS), Decision Support Systems (DSS), Executive Information Systems (EIS), and Operations Research (OR) models should be approached at a later stage of information systems development and should integrate selected information from less complex applications as well as routine attribute and geographic databases.

If microcomputers are successfully installed and running, and have been designed to support such local governmental functions as utilities, budgeting, and personnel, decisions can be made based on the information processed. However, the question remains as to whether chief administrators

can use microcomputers effectively within their immediate offices. For most cities in Romania, an Executive Information Systems (EIS) and a Decision Support System (DSS) would make sense only as specially designed systems which would sit on top of several databases, department record keeping and smaller applications. Such systems would have to have specially designed interfaces for end users and busy decision makers.

Evaluate Needs and Resources Realistically

A careful evaluation of needs and resources should be made prior to building an application system for the City Hall. *Norris* (1986) notes that "although the benefits of microcomputers appear to outweigh their liabilities, research suggests that experiences with them are not universally satisfactory. Inappropriate hardware and software are purchased; machines break down; users are not trained and supported adequately; computerphobia and increased job stress occur; and unnecessary duplication of effort takes place". In evaluating the need for computer applications for a City Hall, and to help current users evaluate new applications, the following guidelines are offered by ICMA (1988b):

1. Decide what information you need. Computers can generate enormous amounts of information. Before a staff member spends hours typing information into a database or spreadsheet, be sure that you need the information that will be generated.
2. Decide who should be trained. Training is time consuming, and if you are not a regular user, you might need to be retrained every time you use the computer. A department might more effectively use the computer if only two or three people are trained.
3. Determine what applications will be productive. Various surveys show that word processing, spreadsheets, and databases are the most common applications in the local government departments and in the Mayor's office. They can be easily learned and, if properly used, will result in time savings, improved quality, and greater productivity. Caution is advised in evaluating other applications. It is easy to waste thousands of dollars and many hours of training on software that may have limited utility.
4. Provide user training and support. A variety of training possibilities are available, including joint training with a local school or university system or other local government. Staff must be given enough time away from their daily work tasks to learn to use the computer.
5. Regularly evaluate the effectiveness of microcomputer use. Questions to ask in evaluating the effectiveness of computers include: Is more information being generated from the computer than is actually needed to make good management decisions? Are expensive computer services being purchased although they have limited utility for the office? Are the computers in the office compatible with one another? Are unnecessary software and hardware being purchased?

Evaluate Off-the-Shelf Software

In evaluating off-the-shelf software, the categories which should be considered are: performance, documentation, ease of learning, ease of use, error handling, support, and value. Experts in software acquisition suggest additional criteria for off-the-shelf evaluation, such as cost, internal product integration, interface/integration with software from other vendors, ease of installation, performance speed, and purchase terms.

Perform a Cost-Benefit Analysis

Some form of cost-benefit analysis should be used so that decision-makers will know how much the system is likely to cost. Total system costs should be identified both for initial installation and for continued operation. Total system costs include at least the following:

- Hardware: CPUs, monitors, printers, plotters, modems, cables
Application programs, whether off-the-shelf or packaged, or the cost of program development and the cost of any required customization or modification
- Training
- Hardware maintenance
- Software support
- Supplies: paper, ribbons, toner, disks
- Electrical connections for LAN, including room modifications
- Additional furniture: desks, tables, storage
- Conversion of data from current systems and methods

The costs should be projected for one-year and either three- or five-year periods to provide a clear picture of both initial and system life costs. Out-of-pocket costs can be expected to be substantial, but the functional benefits and capabilities of the system may more than outweigh the monetary costs.

Determining cost-effectiveness may be the most difficult part of the procurement effort. If it can be justified functionally (for example, to improve the performance of one or more activities) and a department has money in its budget, it may purchase the hardware and software. Cost-benefit alone may be insufficient to establish the feasibility of buying equipment. Analyses have shown that over a five-year period, a new computer system could be financed out of actual cost savings. In many cases, lack of communication between staff and elected officials has delayed considerably this activity.

Build a Consensus

Several measures can be taken to achieve a consensus for the procurement, development, and use of a computer system for a City Hall. They include a sound requirements analysis; objective cost-benefit analysis; and open, honest communication between key staff persons and elected officials.

Communication is critical throughout the process because it promotes understanding of the need, costs, and impacts of automation. Understanding, of course, does not necessarily result in support, but, at a minimum it provides all participants with a common framework and promotes educated decision-making.

Computer Systems Priority Applications for a City Hall

In their attempt to define and build computer applications to support local public administration and planning activities, cities will be confronted with major difficulties: 1) lack of financial resources and local financial autonomy; 2) continuation of the command-and-control practices and hierarchical relationships of the old regime; 3) confusion in the application of Law, in particular in the areas of land/ buildings/ assets ownership; 4) lack of managerial skills for the implementation of its vision and its drive towards local autonomy; and 5) severe understaffing .

Such constraints point towards a gradual implementation of a computerized approach in the City Hall, with major applications, such as a computerized master plan and cadastre system, delayed until experience with simpler applications is gained and consolidated, and legal and operational clarifications are in place for dealing with land/buildings/assets ownership issues.

The difficult job that the City Hall is undertaking is somewhat facilitated by significant resources available at the local level, such as leadership and vision, technical expertise available on microcomputer programming and use, high potential for finding creative solutions to problems, and reasonably adequate and powerful hardware support.

Categories of Users and Types of Applications for Cost-Effective Computerization

Within a City Hall, microcomputers software and applications typically could be used by four categories of officials or personnel: 1) elected officials; 2) managers; 3) professional-technical staff; and 4) secretarial-clerical employees.

As applications develop, the principal microcomputer users must be the professional-technical staff and the secretarial-clerical employees. The secretarial-clerical employees must continue to be trained by the programmers and operators in the Information Systems Office to use basic micro software, such as word processing and spreadsheets, to prepare correspondence, memos, and documents. The professional-technical staff must be trained both by the in-house specialists and by specialized software vendors, in the use of spreadsheets, databases, and accounting, budget, and financial packages provided by the vendors. The targets for immediate and simple computer applications are the offices in the City Hall departments, which vary from city to city.

In one to two years, when comprehensive and carefully structured databases will be available in each of the offices, managers (office chiefs and heads of departments) must be convinced and trained to use more sophisticated reporting packages, as well as communication software, such as

e-mail and bulletin boards, in order to effectively and efficiently control the flow of information in their departments and within departments.

The involvement of office chiefs and heads of departments in the use of MIS is a prerequisite of the development, in a longer term perspective, of Decision Support Systems (DSS) and Executive Information Systems (EIS) for the direct use of the mayor and elected officials. Although the topic is highly premature, it is useful to keep in mind that both DSS and EIS require a different interface development approach, with emphasis on user-friendly features and/or fully automated user interface to make the best use of the chief manager's limited time.

Priority Applications and a Systems Development Process

The first priority computer applications for a City Hall fall into two categories: internal housekeeping applications, and service providing to the citizens. The immediate computerization needs within the first category are accounting and budget planning, while the critical application in the second category is document tracking.

The first applications should focus on word processing (minutes, agendas, reports, proposals, newsletters), spreadsheets (tables, simple financial reports, financial agendas and plans), and relational databases (inventories, lists of customers, suppliers, addresses and telephone/fax numbers, planners/organizers, etc). Accounting and budget software development should be contracted out to local software companies which should provide support, training, upgrades, and services related to the software. Then, the accounting and budget applications will, of course, become a daily routine for the City departments involved.

The Principal Data that Should be Computerized

The principal data that should be computerized are (by office):

1. *The Secretariat, the Registrar's Office and the Archive:* document tracking.
2. *The Office for Legal Affairs and Social Assistance:* welfare records for large families, child subsidy records, energy subsidy records.
3. *The Office of Civil Status:* births and deaths records, marriage and divorce records.
4. *The Office of Management, Payroll, Personnel, and Administration:* personnel data, payroll.
5. *The Office of Budget and Accounting:* materials and assets inventory and management, fixed assets inventory and management, invoicing and billing, accounting, budget planning and operation.

6. *The Office of Architecture and Urbanism*: certificates of urbanism and building permits, master plan (long-term or special project).
7. *The Office of Regional Planning, Environment, Cadastre, Topographic and Geodesic Services, and Land Records*: land use and cadastre data and maps (long-term or special project).
8. *The Office for the Records and Management of the Patrimony*: patrimony/records keeping.
9. *The Office of City Management and Services*: data on municipal services, data exchange with *regii autonome*.
10. *The Office of Investments, Auctions, and Public Works*: records on public bidding, proposals, etc.
11. *The Office for Audits and Inter-Departmental Coordination*: records of citizen complaints, tracing, and decisions.

Approach and Procedure for Developing and Obtaining Appropriate Software

The specifics of local government in Romania, both historically and during the current transition to a market economy, make it difficult to apply directly off-the-shelf software widely available in developed countries in the local public administration process. A specific legal framework, the different needs and different organization and management of the local government, as well as the language barrier, increase the difficulty of using internationally available software packages, certainly during the first stages of computerization. Consequently, the immediate solution is to rely on locally available software for planning and local government applications.

The *Center for the Transfer of Information Technologies to Public Administration* (CTTI-AP), located in Bucharest, offers information about software development companies in Romania. Their survey shows that most local private software companies are too small to be reliable, and to effectively and efficiently provide cost-effective software applications, maintenance and support to local governments. CTTI-AP, which was founded by the *National Commission of Information Technology*, reflects the views of the central government, which have not changed much from the previous regime. The Commission's *Master Project of Information Technology in Romania* (*Proiectul Director al Informatizarii in Romania*), issued in September 1992, displays an incredibly rigid hierarchically structured strategy of computerization of all socio-economic activities in the country.

Similarly, CTTI-AP's *Proposal for the Development of Management Information Systems for the Local Government* proposes a highly unrealistic and useless scheme of a hierarchy of computer and software centers to support applications and to train staff from the local government, all

coordinated by a central unit located in Bucharest. In addition to that, the Center currently promotes sophisticated GIS and other applications, which most municipalities lack the resources to acquire, use, and maintain. The implied assumption is that funds for such applications will be available - sometime in the future - from the central government.

Equally unrealistic in the early stages of development of the system are the solutions offered by local and national software resellers, such as *A & C International*, who try to sell the local governments CAD/CAM systems, GIS, Lotus NOTES, and other sophisticated packages. Those packages not only require a significant initial investment, but also local expertise, training, dedicated staff and, more important, clear and transparent management structures, with well-defined responsibilities, lines of authority, and reporting procedures. Such is clearly not the situation with the local governments in Romania during the transition to a market economy.

In contrast, certain local software development groups have been producing simple, easy-to-use applications in the Romanian language, for accounting, payroll, and financial purposes. In addition to turnkey systems, companies offer applications for the City Hall in the following areas: 1) budget planning and operation; 2) capital investment program management; 3) directory of streets and address matching; and 4) birth and death records.

Scope of Work and Suggestions for an Initial Priority System

An Initial Priority System

In addition to developing a systems design strategy, evaluating the City Hall needs and resources, and assessing the availability and feasibility of acquiring locally developed software, three additional issues must be addressed by the City Hall:

1. *Cost issues: how much will the work plan recommendations cost?*

A cost-benefit analysis should be performed and total system costs should be identified both for initial purchase and installation and for continued operation. Total system costs should include the cost of hardware, software, training, maintenance, data conversion, office supplies and furniture.

2. *Who will be responsible for what? Does the City have the skilled staff to input the data which should be computerized?*

The role and responsibilities of the Office of Information Systems should be clearly laid out. What would the role of the programmers in the office be, and how would computer operators support this effort? ICMA recommends the programmers' direct involvement in in-house software development and training activities in the first implementation stages of the plan, while assigning them supervision and management roles in the later stages, when a host of software applications are in place, which need to be coordinated. Likewise,

computer operators should be hired who should train and work closely with the end users in various departments to develop data entry and processing procedures, as well as simple, customized applications responding to immediate needs of those departments.

3. *How should technical services and software be procured, i.e. sole source or competitive? Who is going to be in charge of writing procurement specifications?*

ICMA recommends that, with very few exceptions, competitive bidding should be put in place for software and service procurement. In order to receive the best quality of services for the expense, i.e. the most cost effective services, a City Hall should consider breaking down the jobs and services procured into smaller tasks, to encourage smaller businesses and individual consultants to participate in the bidding process.

Long Term and Special Projects

The next step in developing information systems for the local government is to start long term and special projects, requiring substantial financial and human resources. Such projects become feasible only if substantial funding is available internally (either from the central government, or from local sources, once local governments become financially viable and autonomous) or from external sources. For extensive projects, a combination of technical assistance projects, with grants and loans from international donors might be necessary. Such projects could be the ones mentioned below.

Geographic Information Systems (GIS)

GIS applications and satellite imagery can be used cost-effectively in developing the master plan of the city. Such a project would allow the municipality to update the land and asset inventory, and to control growth, while attracting and retaining businesses and, possibly, foreign investors.

A cost-effective solution would be to use a desktop GIS, such as Atlas GIS for Windows, MapInfo for Windows, or ArcView 2.0, and to purchase satellite pictures for easy annual updating of the land use maps. All implied costs should be taken into consideration, including the cost of contracting out the socio-economic and demographic surveys, or special studies, such as the touristic potential of the region. Also, the updating and monitoring should be costed in order to insure the efficiency and effectiveness of the effort.

The Municipal Cadastre System

Such a project can be extremely complex and expensive and requires careful planning and feasibility studies. There are numerous examples of cities in developed countries which failed miserably in a too ambitious attempt at implementing sophisticated cadastre systems which eventually cost three to ten times the projected costs, and had to be abandoned.

Decision Support Systems (DSS) and Executive Information Systems (EIS)

Such applications require not only extensive, accurate and structured databases and Management Information Systems (MIS), but also clear and transparent management structures, with well-defined responsibilities, lines of authority, and reporting procedures.

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